(*Asterodon*) are so named because of the presence of stellately branched cystidia. In *Mycena lasiosperma* Bres.,[8] the ends of the cystidia are several times branched. The ends of the cystidia in several species of *Pluteus*[9] are branched into a group of verticillate prongs. Their presence, absence, or variability in certain genera is as often accounted for by the action of the systematist as by any natural relationship of the forms.—GEO. F. ATKINSON.

Salt marsh development.—The theories advanced for the origin and development of salt marshes, with their typical plant associations, have postulated a shore being built up in bays, estuaries, and barrier-protected lagoons by organic matter resulting from the marsh vegetation and its entangled silt, resulting in a progressive plant succession. Recently DAVIS[10] studied numerous sections of salt marshes in the vicinity of Boston, and found that the deposits were largely composed of the remains of salt marsh plants growing only within a vertical range of about three feet from high tide; and still more remarkable, thick beds of peat formed almost entirely from turf built by *Spartina patens*, a salt marsh grass with even more restricted vertical range. In other instances fresh water deposits were found below the salt marsh peat. Similar but much more limited data previously presented by PENHALLOW, as a result of investigations on the Maine coast, in an article reviewed in this journal,[11] caused him to assign to the phenomena the same explanation as that now given by DAVIS, namely, that the coast has for centuries been gradually subsiding. Peat deposits sixteen feet in thickness indicate this as the minimum amount of subsidence in the Boston area. This region, therefore, would present an interesting example of a static plant formation as a response to an actively dynamic topography, the rate of upbuilding by the vegetation being the same as that of the coastal subsidence. That subsidence was not constantly maintained throughout the entire period of time required for the formation of the deposits under investigation is shown by the presence of at least one bed of fresh water peat including tree stumps between two layers of *Spartina patens* turf.

Further evidence of a similar character is furnished by BARTLETT[12] from a study of a marsh at Woods Hole (Mass.), where similar peat deposits were found with large stumps of *Chamaecyparis thyoides* upon the beach where they were submerged at high tide and yet under conditions where there could have been no lowering due to undermining. Sections of this marsh also showed fresh water deposits sixteen feet below the present high tide level. Such data

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[8] Fung. Trid. 1:33. *pl. 37. fig. 1.* 1883.

[9] For example, see *Pluteus cervinus* in PATOUILLARD, N., Tab. Analyt. Fung. 1:152. *pl. 335.* 1885.

[10] DAVIS, CHARLES A., Salt marsh formation near Boston and its geological significance. Economic Geology 5:623–639. 1910.

[11] BOT. GAZETTE 45:352. 1908.

[12] BARTLETT, HARLEY H., The submarine *Chamaecyparis* bog at Woods Hole, Mass. Rhodora 11:221–235. 1909.

necessitate a modification of the current theories for the development of salt marshes, and lead DAVIS to conclude that "salt marshes in the area under consideration are features of and an accompaniment to coastal subsidence." The rate of subsidence is variously estimated by these and other investigators at from rather less than one foot per century to double that amount.

BARTLETT shows that a close relation exists between the chlorine content of the soil water and the limits of the various plant associations in the salt marsh. Similar data are given by HARSHBERGER[13] for some of the salt marshes of New Jersey. These are mostly formed behind barrier beaches and are of relatively small area. Probably the most valuable portions of this paper are careful plant lists and the plotting of the vegetation of various typical areas, which will permit further investigators to trace with exactness the development and succession of the various plant associations. It also affords records of the natural vegetation in a region where man is making such changes in the surface and drainage that the original plant associations are rapidly disappearing. Similar records are also given for certain fresh water ponds and swamps formed by the advance of sand dunes across the outlet of various streams.—GEO. D. FULLER.

Biological life forms.—RAUNKIAER'S application of his biological life forms to phytogeography has been translated into German by Miss TOBLER,[14] so that his interesting results are now available to a wider circle of readers. His classification of plants into thirty biological types, based primarily upon the method by which the plant passes the unfavorable season of the year, has already been discussed in this journal.[15] These have now been reduced to ten somewhat broader groups: stem succulents, epiphytes, megaphanerophytes and mesophanerophytes, microphanerophytes, nanophanerophytes, chamaephytes, hemicryptophytes, geophytes, helophytes and hydrophytes, and therophytes or annuals. The flora of a region is then classified into these ten groups, and the number of species in each group expressed in per cent of the total. This numerical arrangement is called a biological spectrum. By arranging these spectra for different regions in order, there is given an easy method of comparing the life forms of vegetation, not only with each other, but also with the flora of the world as a whole. From these spectra it is seen that the tropics are characterized by an excess of the various classes of phanerophytes, deserts by chamaephytes and therophytes, the temperate zone by hemicryptophytes, and the arctics by hemicryptophytes and chamaephytes. For the more northern floras the author finds that the number of chamaephytes

[13] HARSHBERGER, JOHN W., The vegetation of the salt marshes and of the salt and fresh water ponds of northern coastal New Jersey. Proc. Acad. Nat. Sci. Philadelphia **61**:373–400. 1909.

[14] RAUNKIAER, C., Statistik der Lebensformen als Grundlage für die biologische Pflanzengeographie. Beih. Bot. Centralbl. **27**^{2}:171–206. 1910.

[15] BOT. GAZETTE **44**:392. 1907.